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EXPLORING MIDDLE SCHOOL STUDENTS MATHEMATICS SELF-EFFICACY AND MATHEMATICS ANXIETY

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Abstract:
This research was carried out to examine middle school students' perceptions of mathematics self-efficacy and their concerns about mathematics. In the research, the Mathematics Anxiety Scale was used to determine students' anxiety levels and the Self-Efficacy Scale was used to determine the level of self-efficacy perceptions. The sample of the study consists of 169 middle school students studying in a middle school in Kayseri in the 2019-2020 academic year. Middle school students were identified by a convenient sampling method, and the research was supported by a survey model from quantitative research methods. Independent groups t-test was used to determine whether students' perceptions of self-efficacy and anxiety levels differed by gender, and Pearson correlation analysis was used to determine the relationship between anxiety and self-efficacy. Results showed that math anxiety levels did not differ significantly according to gender. Mathematics anxiety levels did not differ significantly according to grade level, while mathematics self-efficacy differed according to grade level. It was observed that there was a moderately significant relationship between mathematics anxiety levels and mathematics self-efficacy perceptions of middle school students.

Keywords: mathematics self-efficacy, mathematics anxiety, middle school students

1. Introduction

Human beings use mathematics to understand nature and to survive in the world. Mathematics is not learned only for success in exams but for our life. Mathematics is necessary to improve analytical thinking and to transfer them to daily life to make life

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easier. If we consider that math was met by counting at a very young age, we can talk about the existence of mathematical skills from the early stages of our lives. From that age on, mathematical processing skills, knowledge of mathematics developed. Learning, shaped with the environment, the reactions lead to the development of attitude towards mathematics. Individuals' perceptions of mathematics greatly affect their learning of mathematics. If the student has a prejudice against mathematics, if (s)he is concerned, (s)he will not understand and fail the subject to be explained as a result (Yenilmez & Özbey, 2006).

Turkish Language Institution (Türk Dil Kurumu-TDK) defined anxiety as the uneasy feeling that occurs when a request seems unattainable. Anxiety has been the subject of research for many years, and research continues with different variables and samples. Sigmund Freud was the first scientist to deal with anxiety disorder. He grouped it into three types of anxiety as real anxiety, neurotic anxiety and moral anxiety. Real anxiety is used in the same sense as fear and is experienced in danger. Neurotic anxiety occurs as a result of predicting that events will occur. It appears as anxiety, feeling of escaping, losing control. Moral anxiety occurs as a result of the conflict between ego and super ego.

Anxiety occurs in response to a situation that occurs. Individuals are anxious when they realize that things will not be what they think. Its causes and how it came about. Causes are not known to the person, but its effects are known to the individual and it is an uncomfortable feeling (Davarcıoğlu, 2008). Mathematics anxiety appears as difficulties in problem solving, processing, taking the math exam, and learning subjects. This anxiety is widely seen from primary school students to university students (Baloğlu, 2001). Anxiety is a situation that affects the student negatively. It causes the student to move away from the lesson, to be afraid, to increase the panic state of their anxiety about mathematics and to decrease their perception with it, and to hate mathematics in case of failure (Alkan, 2010; cited in Şentürk, 2012). Davarcıoğlu (2008) talked about body reactions. He explained fear as the suddenly felt excitement. He stated that his physical anxiety occurred with the symptoms of not being able to breathe, flushing, heart palpitations, tremors, and fainting. There are many reasons for mathematics anxiety. The family's attitude, student's negative memory about the mathematics teacher, exam anxiety, grade anxiety, student absenteeism, socio-economic status, environmental factors can be counted. Anxiety is inevitable because the perception of mathematics is difficult by the society. Bozkurt (2012) analyzed 7th and 8th grade students' mathematics achievement exam anxiety and math anxiety in terms of variables such as gender, grade, mother and father education level, occupational status, number of siblings. In his research, he concluded that as students' exam anxiety increased, their success decreased. Exam anxiety increased as math anxiety increased. In addition, it was revealed that the anxiety of students who love mathematics is higher than the anxiety of students who do not like it. No significant mean difference was observed for mathematics anxiety in terms of gender, parental occupation, and number of siblings.

Şentürk (2012) examined the math anxiety of fifth grade students in terms of different variables. In this study he conducted with 510 students, and determined that

female students' math anxiety was lower than male students' math anxiety. In addition, it was revealed that as the grades of the students increased, their math anxiety decreased. Yenilmez and Özbey (2006) conducted a research on the concerns of private and public school students about mathematics. He stated that 5th grade students were more anxious than 6th and 7th grade students. Students whose mothers are primary school graduates have higher math anxiety than those whose mothers are university graduates; Likewise, it has been determined that students whose fathers are primary and secondary school graduates have more math anxiety than those whose fathers are university graduates.

Math anxiety is a phenomenon that makes learning mathematics difficult for many different reasons. Understandably, unlearned mathematics also affects students' self-efficacy perception. Self-efficacy perception is one of the determining factors affecting one's mathematics success. Self-efficacy is the belief that one is required to be aware of the capacity of one's own abilities, to bring himself to the desired level. Individuals with high self-efficacy also have high academic success (Bandura, 1997; cited in: Kahramanoğlu & Deniz, 2017). If the student's belief that he can learn mathematics increases, his self-efficacy also increases. People with high self-efficacy in mathematics will be more comfortable with the problem and solve the problem. However, individuals with low mathematics self-efficacy cannot worry and cannot provide the necessary efficiency. If the student is taught success with various activities and self-confidence is increased, self-efficacy will also develop.

Doruk, Öztürk and Kaplan (2016) examined the self-efficacy of secondary school students. He addressed this with anxiety and attitude factors. In their study with 246 secondary school students, students' self-efficacy perceptions were high, and their math anxiety levels were low. A negative relationship was found between self-efficacy and anxiety. Kıbrıslıoğlu Uysal and Haser (2018) examined the students' beliefs about mathematics and their mathematics self-efficacy in their research with 750 fifth grade students in 14 different schools. They stated that fifth grade students' gender self-efficacy averages were close to each other and that these students had high self-efficacy beliefs. Likewise, in the study of Yılmaz (2011) with middle school students, they stated that the self-efficacy belief of the students decreased as the grade level increased.

When studies on self-efficacy are examined, there are also studies on mathematics self-efficacy of high school students. Taşdemir (2012) researched the mathematics self-efficacy level of high school senior students and collected data from a total of 325 students studying in General High School, Anatolian High School, Anatolian Teacher High School, Science High School and Private High School. When analyzed by gender, he stated that mathematics self-efficacy differed significantly in favor of men. When the types of schools are analyzed, it is stated that the Science High School students' self-efficacy perceptions are highest, followed by Anatolian Teacher High School, and then they are ranked as Private High School, Anatolian High School and General High School. In the study, significant mean differences were found according to gender school type and it was determined that there was no significant mean difference according to the income level of the family and the place of residence. Research has been conducted to

examine the relationship between anxiety and self-efficacy. With this study, we aimed to benefit the literature.

2. Aim of the Study

The aim of this study is to examine middle school students' perceptions of mathematics self-efficacy and their concerns about mathematics with various variables. In addition, it is aimed to examine the changes of these two scales depending on gender, class level, mother education level, father education level variables. The research problem is to examine middle school students' perceptions of mathematics self-efficacy and their concerns about mathematics. Sub-research problems:

1) What is the level of self-efficacy and anxiety of students towards mathematics?
2) Do the students' self-efficacy perceptions and anxiety towards mathematics course differ according to their gender?
3) Is there a relationship between mathematics self-efficacy perception and mathematics anxiety?
4) Do the students' self-efficacy perceptions and anxiety towards mathematics course differ according to the grade level?
5) Did the level of family education affect students' anxiety towards mathematics and their self-efficacy regarding mathematics?

2.1 Assumptions and Limitations

The assumptions of this research:

1) It is assumed that students answer the “math anxiety scale” and “mathematics self-efficacy scale” with honesty.
2) It is assumed that the data show normal distribution and the data are homogeneously distributed.

Limitations in this research:

1) This research is limited to the academic year 2019-2020.
2) It is limited to 169 students studying in a middle school in Melikgazi district of Kayseri province.

3. Method

In this section, the research model, sample, data collection tools, data collection method and analysis are given.

3.1 Research model

Survey model, one of the quantitative research methods, was used. Survey models are scan models that aim to determine whether two or more variables change together, if there is a change (Karasar, 2018). In this study, it was aimed to determine the self-efficacy perceptions and anxiety of students towards mathematics. It has been tried to describe

with variables such as gender, grade level, mother education level, father education level that may be associated with these.

3.2 Sample

Participants were determined by convenient sampling method, which is easily accessible by the researcher. The sample of the study consists of 169 middle school students studying at the middle school affiliated to MoNE in Kayseri in the academic year 2019-2020. As given in Table 1, it consists of 85 (50.3%) female students and 84 (49.7%) male students.

Table 1: Gender and grade level descriptive statistics

		n	%	Cumulative %
Gender	Female	85	50.3	50.3
	Male	84	49.7	100
Grade Level	5	36	21.3	21.3
	6	38	22.5	43.8
	7	38	22.5	66.3
	8	57	33.7	100
	Total	169	100	

As can be seen in Table 1, data was collected from all grade levels in terms of representing middle school students. A total of 169 middle school students participated in the survey, including 36 students from the 5th grade, 38 students from the 6th grade, 38 students from the 7th grade and 57 from the 8th grade. All students at the school have been reached by the researcher.

3.3 Instruments

Mathematics Anxiety Scale for Primary Education Students, developed by Şentürk (2010), was used to determine the anxiety levels of students as a data collection tool. Şentürk (2010) stated that the scale has five sub-factors. The first factor is the anxiety factor resulting from the attitude towards mathematics lesson (4 items). The second factor is the anxiety factor resulting from lack of self-confidence (5 items). The third factor is the anxiety factor resulting from the lack of field knowledge (4 items). The fourth factor is the factor resulting from learning anxiety (4 items). The fifth factor is the factor resulting from exam anxiety (5 items). The scale consists of 5 Likert-type 22 items. The reliability coefficient (Cronbach's Alpha) was calculated as 0.93. Reliability coefficient of the sub-factors reliability factor of the first factor 0.84; the reliability factor of the second factor is 0.86; the reliability factor of the third factor is 0.82; the reliability factor of the fourth factor is 0.85; the reliability coefficient of the fifth factor was calculated as 0.80. The scale was rated as "I am always concerned (5)", "I am often concerned (4)", "I am sometimes concerned (3)", "I am very concerned (2)", "I am never concerned (1)". In this study, the reliability coefficient of the math anxiety scale was found to be 0.931. The minimum score that can be obtained on the math anxiety scale is 22, the maximum score is 104.

The Mathematics Self-Efficacy Scale, developed by Abalı Öztürk (2014), consisting of 24 items, was used to measure students' self-efficacy perceptions. The scale is a 5-point Likert type scale. The scale are options such as "never", "very rarely", "sometimes", "often", "always". The reliability coefficient of this scale, which was determined as a single factor, was calculated as 0.95. The scale was scored as "never (1)", "very rarely (2)", "sometimes (3)", "often (4)", "always (5)". The minimum score that can be obtained from the mathematics self-efficacy scale is 40, and the maximum score is 120. In this study, the reliability coefficient of the mathematics self-efficacy scale was calculated as 0.935. The form related to the demographic characteristics of the students was added to scales. As seen in Table 2, when skewness and kurtosis values are examined, it is seen that the values show a normal distribution in the range of +1 to -1 (Tabachnick & Fidell, 2015).

Table 2: Descriptive statistics results on math anxiety and self-efficacy data

Scale	Range	Min.	Max.	Median	SD	Varyans	Skewness	Kurtosis
Anxiety	82	22	104	52.1124	18.4247	339.469	.741	.054
Self-efficacy	80	40	120	93.213	16.7837	281.692	-.775	.404

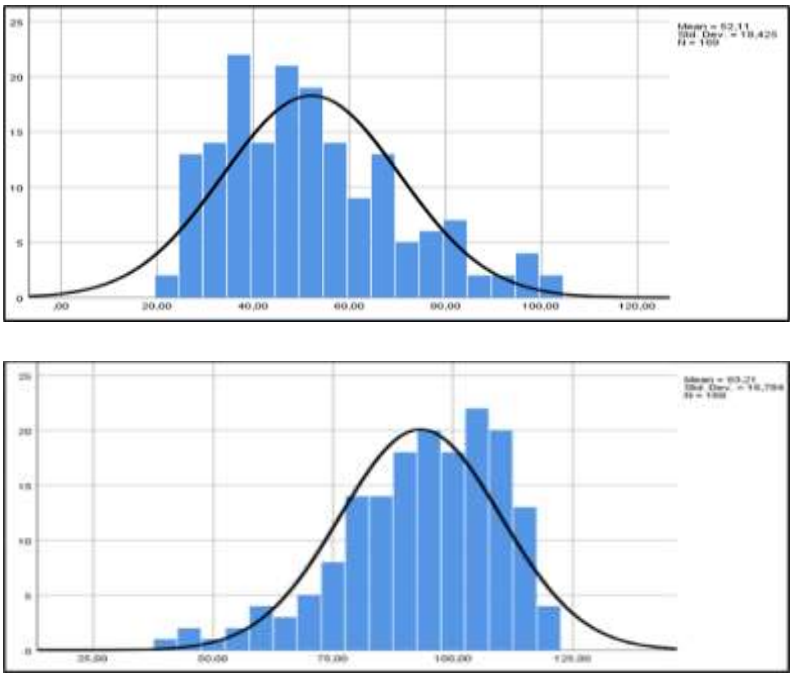


Figure 1: Histogram graphics of (a) Mathematics anxiety scale and (b) Mathematics self-efficacy scale

Histogram of mathematics anxiety average of middle school students is shown in Figure 1(a). It is seen that the average of 52.11 standard deviations is 18.425. Histogram of Mathematics self-efficacy averages are shown in Figure 1(b). It is seen that the self-efficacy average is 93.21 standard deviations of 16.784.

Table 3: Kolmogorov-Smirnov normality test results regarding math anxiety and self-efficacy

Scale	Gender	Statistics	p
Total Anxiety	Female	.104	.023
	Male	.127	.002
Total Self-efficacy	Female	.110	.012
	Male	.071	.200

According to the normality test results regarding Mathematics anxiety and self-efficacy data given in Table 3, our p value is normally distributed only because it is greater than 0.05 in the total self-efficacy perceptions of male students. In the box graph of the math anxiety scale in Figure 3, it can be seen that the girls can reach the normal distribution by removing the data with the extreme value of 125 in the first quarter, where the aggregation is not in the first quarter. In the graph of the mathematics self-efficacy scale in Figure 4, it is seen that there are four extreme values for girls and one for boys.

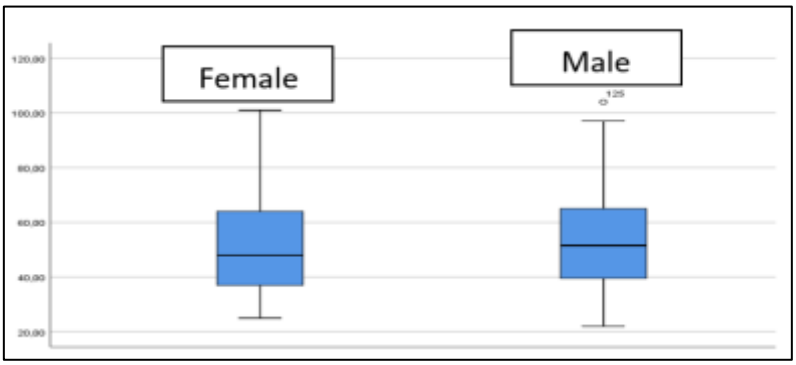


Figure 3: Box chart of the math anxiety scale

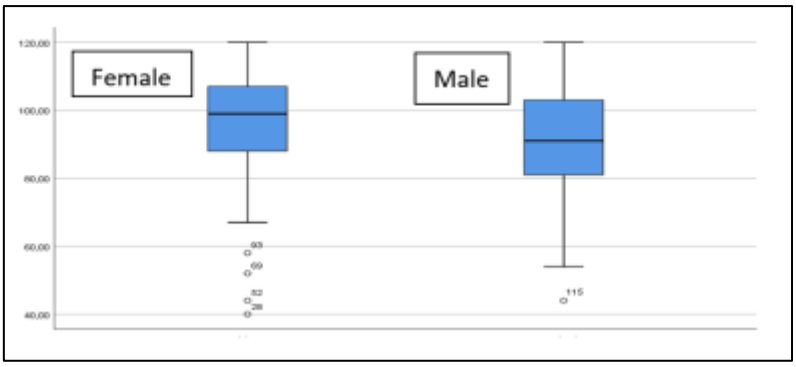


Figure 4: Box chart of the math self-efficacy scale

3.4 Factor Analysis

Before analyzing the math anxiety scale factor analysis, Kaiser-Meyer-Olkin (KMO) value was calculated and Bartlett's Sphericity test was applied to determine its suitability for this analysis. Sample size is sufficient with KMO value 0.927. With Bartlett's value (X^2 = 1983.573, p = 0.00), the data provides normal distribution. As a result of the "principal axis factoring" analysis, it was decided to perform a 3-factor analysis as shown in Table 4.

Table 4: Math anxiety scale factor analysis

	Factor		
Items	**1**	**2**	**3**
Anxiety_12	.743		
Anxiety_2	.704		
Anxiety_3	.652		
Anxiety_13	.607		
Anxiety_11	.596		
Anxiety_1	.557		
Anxiety_6	.436		
Anxiety_7		.693	
Anxiety_5		.630	
Anxiety_8		.601	
Anxiety_9		.570	
Anxiety_10		.563	
Anxiety_4		.510	
Anxiety_19		.495	
Anxiety_20		.480	
Anxiety_16			.683
Anxiety_17			.664
Anxiety_22			.638
Anxiety_15			.616
Anxiety_14			.606
Anxiety_21			.597
Anxiety_18			.532

When Figure 5 is examined, it is seen in the third item that the line approaches 1. Since the contributions to the total variance decreased after the third item, the number of factors was taken as 3. The first factor constitutes 19.118% of the total variance, the second factor constitutes 16.527% and the third factor constitutes 15.954%. The total explained variance is 51.598%.

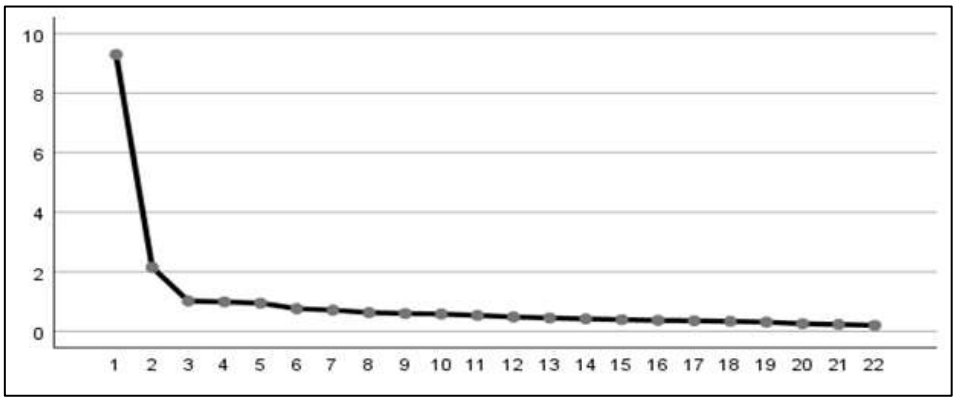


Figure 5: Scree plot of anxiety scale items

Kaiser-Meyer-Olkin (KMO) and Bartlett's Sphericity value were estimated to determine the suitability of this analysis before the mathematics self-efficacy scale factor analysis. Since the KMO value is 0.931> 0.05, the sample size is sufficient. When Bartlett's Sphericity value (X^2 = 1857.472; p = 0.00) is significant, the sample has a normal

distribution. As a result of the "Principal axis factoring" analysis, it was decided to perform a 4-factor analysis as shown in Table 5.

Table 5: Mathematics self-efficacy scale factor analysis

	Factor			
Items	**1**	**2**	**3**	**4**
Self-efficacy_6	.601			
Self-efficacy_13	.566			
Self-efficacy_14	.541			
Self-efficacy_8	.534			
Self-efficacy_4	.522			
Self-efficacy_22	.512			
Self-efficacy_17	.491			
Self-efficacy_11	.476			
Self-efficacy_6		.684		
Self-efficacy_21		.640		
Self-efficacy_18		.555		
Self-efficacy_19		.534		
Self-efficacy_20		.484		
Self-efficacy_1		.459		
Self-efficacy_3			.618	
Self-efficacy_7			.577	
Self-efficacy_9			.490	
Self-efficacy_2			.489	
Self-efficacy_15			.410	
Self-efficacy_12				.479
Self-efficacy_10				.479
Self-efficacy_24				.445
Self-efficacy_23				.416
Self-efficacy_5				.335

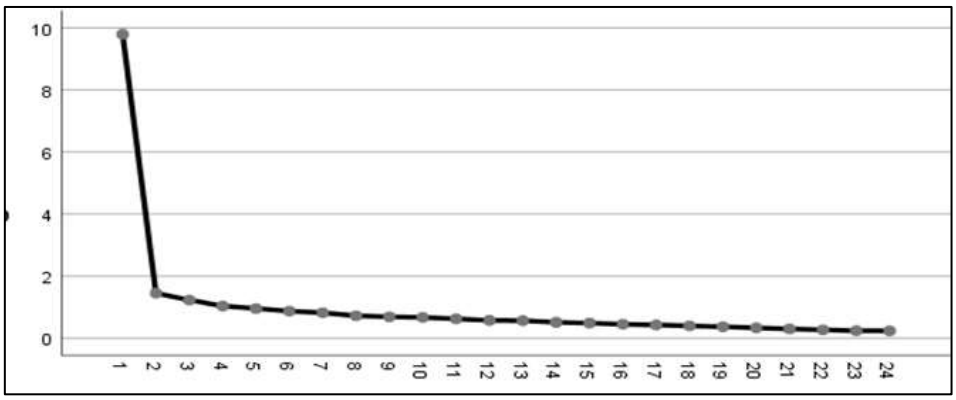


Figure 6: Scree Plot of the self-efficacy scale

When Figure 6 is examined, it is seen that the line approaches 1 after item 4. Therefore, it was deemed appropriate to perform a 4-factor analysis. The first factor constitutes 14.066% of the total variance, the second 13.148%, the third factor 11.003% and the fourth factor 9.401%. The total explained variance is 47.617%.

3.5 Data Collection

Within the scope of the research, the data were collected from 169 middle school students studying in a middle school in Kayseri, Melikgazi district in the first semester of 2019-2020 academic year. During the application of the scales, it was stated by the researcher that the identity information of the participants was not required by explaining the importance and content of the research. Necessary explanations were made for students to answer sincerely. Mathematics anxiety scale, mathematics self-efficacy scale and personal information form were given by the researcher with sufficient time.

3.6 Data Analysis

In the research, using the SPSS 21 package program, math anxiety and math self-efficacy variable, gender, grade level, parental education levels were analyzed in computer environment. Attention was paid to make the coding of the students regarding gender, grade level, education level of parents completely. In order to prevent confusion in the study, the data was enumerated from 1 to another 169, and data was entered into the system.

4. Results

The findings obtained as a result of the analyzes made in accordance with the purpose of this research are included in this section.

4.1 Anxiety and Self-Efficacy Perceptions towards Mathematics by Gender

In order to determine whether mathematics self-efficacy perception and mathematics anxiety vary according to gender, Mann Whitney U test, which is one of the non-parametric tests, was used.

Table 6: Nonparametric test statistics

Scale	Gender	n	Mean Rank	Sum of Ranks
Total Anxiety	Female	85	81.11	6894
	Male	84	88.94	7471
Total Self-efficacy	Female	85	92.46	7859.5
	Male	84	77.45	6505.5

Descriptive statistics obtained from mathematics anxiety scale and mathematics self-efficacy scale are given in Table 6. According to the Mann Whitney U test, the average of mathematics anxiety between female and male [Mann Whitney U = 3239; z = -1.041; p = 0.298] and does not differ significantly. Although the average of students' mathematics anxiety is high, this difference is not statistically mean significant. However, when we look at the average of self-efficacy between female and male [Mann Whitney U = 2935; z = -1.996; p = 0.046] and there is a statistically significant mean difference. Although the self-efficacy averages of female students are higher than the self-efficacy averages of male students, they are not statistically significant mean difference.

4.2 The Relationship Between Mathematics Anxiety and Mathematics Self-Efficacy

The relationship between middle school students' math anxiety and mathematics self-efficacy perceptions was examined. When Pearson correlation is examined ($r = -0.447$, $p = 0.00 < 0.05$), there is a negative relationship between mathematics anxiety and self-efficacy. It is seen that there is a moderately meaningful relationship in the negative direction (Büyüköztürk, 2006).

4.3 Anxiety and Self-Efficacy towards Mathematics by Grade Level

Mathematics anxiety and self-efficacy averages of middle school students were examined at the grade level. Descriptive statistics of mathematics anxiety and mathematics self-efficacy scale at grade levels are given in Table 7. When we look at the mean in Table 7, it is seen that the anxiety levels of 6th and 7th grade students are low.

Table 7: Grade level descriptive statistics of mathematics anxiety and mathematics self-efficacy scale

Scale	Grade level	n	$\bar{X}$	SD	Std. error	Lower Bound	Upper Bound	Min.	Max.
Total Anxiety	5	36	56.3333	21.51013	3.58502	49.0554	63.6113	22	104
	6	38	48.6053	16.41446	2.66278	43.2100	54.0006	28	91
	7	38	48.5000	19.82048	3.21531	41.9852	55.0148	23	99
	8	57	54.1930	16.08064	2.12993	49.9262	58.4598	26	96
	Total	169	52.1124	18.42470	1.41728	49.3144	54.9104	22	104
Total self-efficacy	5	36	92.0556	18.57024	3.09504	85.7723	98.3388	40	119
	6	38	98.7368	11.10803	1.80196	95.0857	102.3880	80	117
	7	38	95.9737	18.70610	3.03453	89.8251	102.1222	44	120
	8	57	88.4211	16.33133	2.16314	84.0878	92.7543	44	118
	Total	169	93.2130	16.78370	1.29105	90.6642	95.7618	40	120

As seen in Figure 7, math anxiety averages are lower in 6th and 7th grades compared to other grades. The anxiety averages of the 8th grade students are 52.1124 and higher than the anxiety averages of the 6th and 7th grade students. Anxiety levels of 5th grade students are highest.

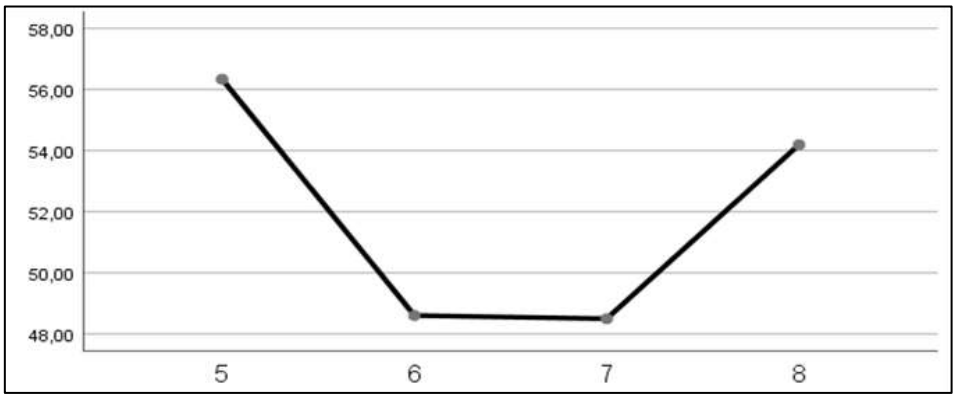


Figure 7: Graph of mathematics anxiety averages of students at grade level

The results of the Kolmogorov-Smirnov test analysis at grade levels are given in Table 8. According to the normality test results, the mathematics anxiety scale does not

show normal distribution in the 6th and 7th grades, while it shows a normal distribution in the 5th and 8th grades. When we look at the mathematics self-efficacy data, it shows normal distribution in the 5th, 6th and 8th grades, but not in the 7th grades.

Table 8: Normality test of grade levels

		Kolmogorov-Smirnov			Shapiro-Wilk		
Scale	**Grade Level**	**Statistics**	**df**	**p**	**Statistics**	**df**	**p**
Total Anxiety	5				.938	36	.045
	6				.908	38	.004
	7				.927	38	.016
	8	.073	57	.200			
Total Self-efficacy	5				.947	36	.083
	6				.952	38	.105
	7				.916	38	.007
	8	.100	57	.200			

When the average of students' perception of mathematics self-efficacy at the grade level is examined, it is seen that the 6th grade students have the highest average.

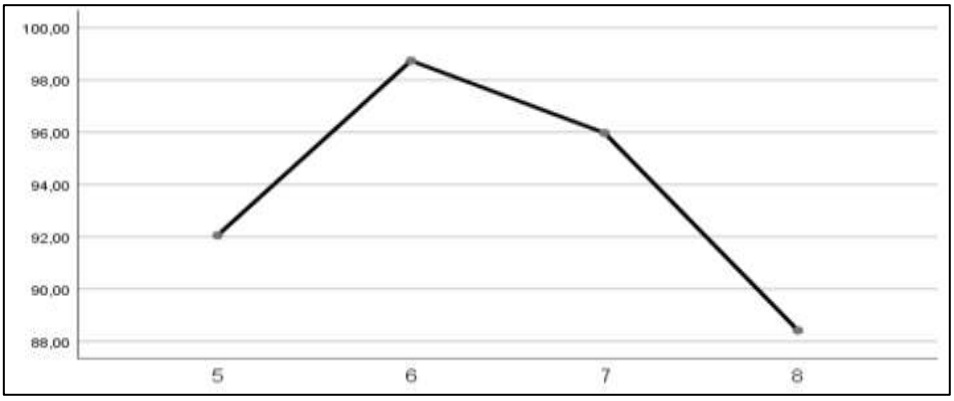


Figure 8: Mathematics self-efficacy averages of students at grade level

According to Figure 8, the eighth-grade students with the lowest self-efficacy are at the bottom. Sixth-grade students had the highest mathematics self-efficacy with an average of 98.7368. Self-efficacy averages of fifth-grade students are 92.0556 and self-efficacy averages of seventh-grade students are 95.9737.

Table 9: Kruskal Wallis analysis results at grade level

Scale	**Grade Level**	**n**	**Mean Rank**	X^2	**df**	**p**
Total Anxiety	5	36	93.83	6.525	3	0.089
	6	38	75.54			
	7	38	73.26			
	8	57	93.55			
Total Self-efficacy	5	36	82.68	10.617	3	0.014
	6	38	99.07			
	7	38	95.92			
	8	57	69.81			

According to the results of the Kruskal Wallis analysis given in Table 9 in terms of grade level in mathematics anxiety scale, it was calculated as X^2 (3,169) = 6.525, p = 0.089. Accordingly, there was no significant mean difference at the grade level. Math self-efficacy perceptions were calculated as X^2(3,169) = 10.617, p = 0.014 according to the Kruskal-Wallis test given in Table 9 according to grade level. Accordingly, it showed a significant mean difference at the grade level. Mann Whitney U test was performed to determine which grade level differed significantly. Table 10 shows the results of the Mann Whitney U test of middle school students' mathematics self-efficacy and anxiety on a grade level basis.

Table 10: Mann Whitney U test results of middle school students' self-efficacy and anxiety on grade level basis

Scale	Anxiety			Self-efficacy		
Group	**U**	**z**	**p**	**U**	**z**	**p**
5-6	537.5	-1.585	0.113	550	-1.450	0.147
5-7	523.5	-1.736	0.083	583	-1.093	0.274
5-8	1015	-0.087	0.931	874.5	-1.195	0.232
6-7	686.5	-0.369	0.712	719.5	-0.026	0.979
6-8	834.5	-1.888	0.059	680	-3.063	0.002
7-8	833	-1.900	0.057	771.5	-2.368	0.018

When Table 10 is examined, when the mathematics self-efficacy perceptions of the grade levels are compared, there is a significant mean difference between the sixth and eighth-grade students in favor of the sixth grade. The mathematics self-efficacy averages of the sixth grades are statistically higher. There was also a significant mean difference between the seventh and eighth grades in favor of the seventh grade. The seventh-grade mathematics self-efficacy averages are statistically higher.

4.4 Anxiety and Self-Efficacy towards Mathematics According to Parent Education Level

The effects of mother education level and father education level on students' anxiety and self-efficacy perceptions were examined. Descriptive statistics of mother and father education levels are given in Table 11.

Table 11: Descriptive statistics of parent education level

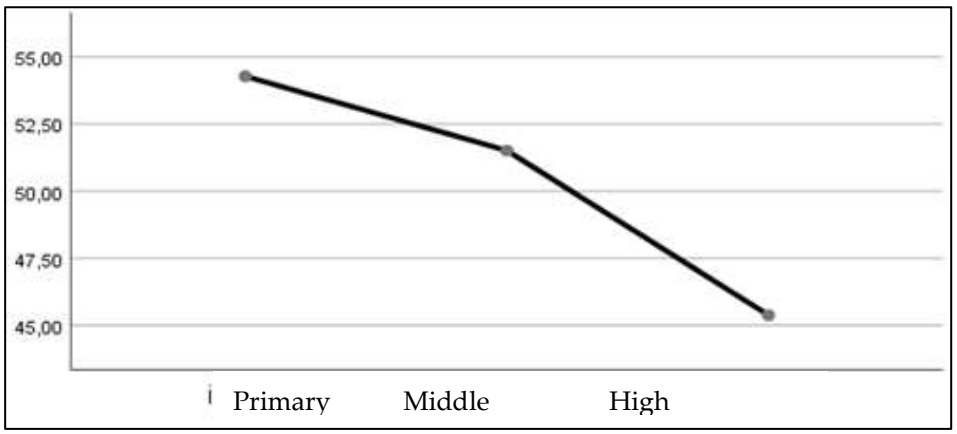
	Mother		Father	
Education Level	**n**	**%**	**n**	**%**
Not-attended to school	4	2.4	1	.6
Primary School	86	50.9	57	33.7
Middle School	55	32.5	49	29
High School	24	14.2	57	33.7
University			5	3
Arranged Groups	**n**	**%**	**n**	**%**
Primary School	90	53.3	58	34.3
Middle School	55	32.5	49	29
High School	24	14.2	62	36.7
Total	169	100	169	100

In Table 11, mothers and fathers who have never attended school in the classification of mother and father education levels are included in the number of primary school graduate mothers and fathers. Likewise, university graduate mothers and fathers are included in the high school graduate group and new groups are given in Table 11.

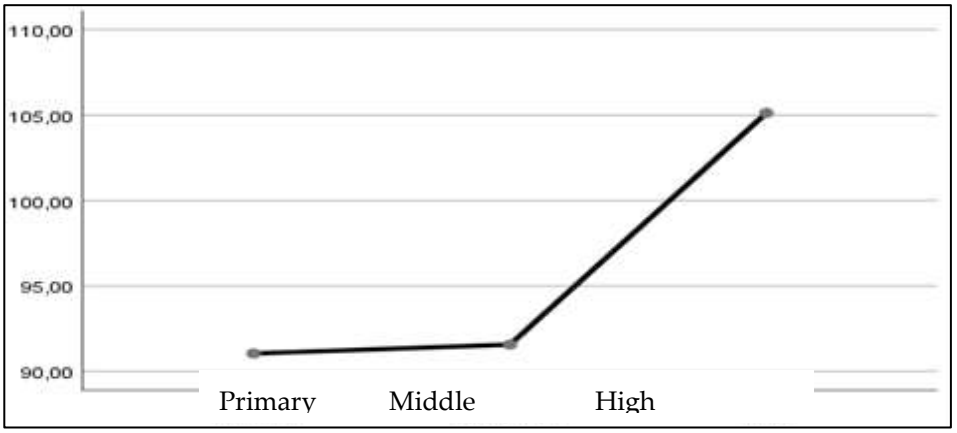
When Table 12 is analyzed, the anxiety level of middle school students whose mothers are primary school graduates is the highest and the anxiety levels of the students whose mothers are high school graduates are the lowest. In addition, the self-efficacy perceptions of the students whose mothers are primary school graduates are the lowest and the self-efficacy perceptions of the students whose mothers are high school graduates are highest.

Table 12: Math anxiety and self-efficacy descriptive statistic values according to mother's education level

		Anxiety				Self-efficacy			
Mother Education Level	**n**	**$\bar{X}$**	**SD**	**Skewness**	**Kurtosis**	**$\bar{X}$**	**SD**	**Skewness**	**Kurtosis**
Primary School	90	54.27	18.55	0.467	-0.227	91.04	17.67	-0.583	0.153
Middle School	55	51.50	19.37	1.031	0.444	91.56	16.03	-0.809	0.430
High School	24	45.37	14.12	0.949	0.914	105.12	8.54	-0.359	-0.348



(a)



(b)

Figure 9: (a) Mathematics anxiety and (b) self-efficacy averages of students according to mother's education level

Figure 9(a) can be seen more clearly with the graph, in which the level of anxiety of the students whose mother education level is primary school is high, and the anxiety level of the students whose mother education level is high school is the lowest. Figure 9(b) made more clearly with the graph in which the self-efficacy level of the students whose mother education level is primary school is the lowest and the self-efficacy level of the students whose mother education level is high school is the highest.

Table 13: Mother education level Kolmogorov-Smirnov test statistics

		Kolmogorov-Smirnov			**Shapiro-Wilk**		
Scale	**Mother education level**	**Statistics**	**df**	**p**	**Statistics**	**df**	**p**
	Primary School	.096	90	**.038**			
Total Anxiety	Middle School	.156	55	**.002**			
	High School				.934	24	**.123**
	Primary School	.063	90	**.200**			
Total Self-efficacy	Middle School	.118	55	**.054**			
	High School				.964	24	**.527**

Table 13 shows the results of math anxiety and self-efficacy Kolmogorov-Smirnov test statistics at the mother education level. The mother education level did not show normal distribution in the anxiety scale in primary and middle schools. It showed a normal distribution in the self-efficacy scale. However, since skewness kurtosis values are between -1 and +1, it is assumed to provide normality for both scales (Tabachnick & Fidell, 2015).

Table 14: Kruskal Wallis test results of the anxiety and self-efficacy of middle school students at the mother education level

		Total Anxiety				**Total Self-efficacy**			
Mother education level	**n**	**Mean Rank**	**X^2**	**df**	**p**	**Mean Rank**	**X^2**	**df**	**p**
Primary School	90	91.94				78.52			
Middle School	55	81.25	5.193	2	0.075	79.33	16.287	2	0.000
High School	24	67.54				122.31			

According to Kruskal Wallis analysis results in math anxiety scale according to the mother's education level X^2 (2,169) = 5.193; It was calculated as p = 0.075. Accordingly, the anxiety scale did not differ significantly at the level of mother education. According to Kruskal Wallis analysis results in self-efficacy perceptions scale X^2 (2,169) = 16.287; It was calculated as p = 0.000 and a significant mean difference was determined. Mann Whitney U test was performed to determine which level of education differs significantly. Table 15 shows the results of the Mann Whitney U test of the self-efficacy and anxiety of middle school students at the mother education level.

Table 15: The results of Mann Whitney U test of the self-efficacy and anxiety of middle school students at the mother education level

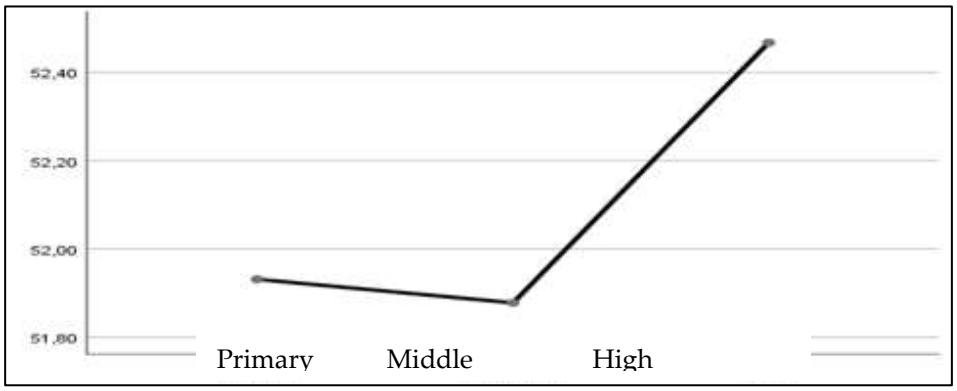
Scale	Anxiety			Self-efficacy		
Group	**U**	**z**	**p**	**U**	**z**	**p**
Primary-Middle School	2165.5	-1.261	0.207	2437	-0.155	0.877
Primary-High School	764.5	-2.193	**0.028**	534.5	-3.793	**0.000**
Middle School-High School	556.5	-1.104	0.270	310	-3.733	**0.000**

When Table 15 is analyzed, a significant mean difference was observed in the anxiety levels of students whose mothers are primary school graduates and whose mothers are middle school graduates. Anxiety levels of students whose mothers are primary school graduates are higher. When the self-efficacy perceptions were examined, a significant mean difference was found between the self-efficacy of students whose mothers were high school graduates and those whose mothers were primary and middle school graduates. Self-efficacy perceptions of students whose mothers are high school graduates are higher.

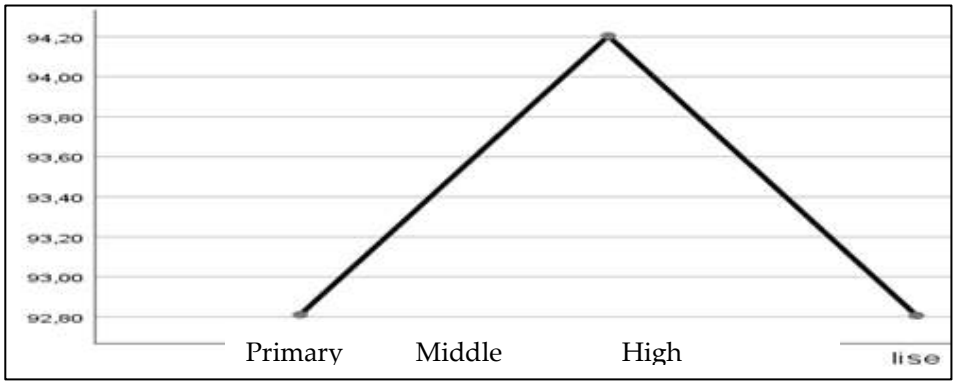
Table 16: Math anxiety and self-efficacy descriptive statistics values according to the father's education level

Father education		Anxiety				Self-efficacy			
level	**n**	$\bar{X}$	**SD**	**Skewness**	**Kurtosis**	$\bar{X}$	**SD**	**Skewness**	**Kurtosis**
Primary School	58	51.93	17.13	0.706	0.492	92.81	16.80	-0.854	0.537
Middle School	49	51.87	19.02	0.490	-0.565	94.20	17.02	-0.791	0.519
High School	62	52.46	19.37	0.968	0.304	92.80	16.81	-0.736	0.472

There are statistically small mean differences in math anxiety levels in Table 16. Anxiety levels of students whose fathers are high school graduates are higher. The self-efficacy of students whose fathers are primary and high school graduates is lower than the self-efficacy of students whose fathers are middle school graduates.



(a)



(b)

Figure 11: (a) students' math anxiety and (b) self-efficacy averages by educational level

Figure 11 (a) father education level of students' anxiety towards mathematics and (b) self-efficacy perception graphs are given. The differences between anxiety and self-efficacy are clearly seen on the graph.

Table 17: Father education level Kolmogorov-Smirnov test statistics

		Kolmogorov-Smirnov			Shapiro-Wilk		
Scale	**Father Education Level**	**Statistics**	**df**	**p**	**Statistics**	**df**	**p**
	Primary School	.130	58	**.016**			
Total Anxiety	Middle School				.951	49	**.040**
	High School	.140	62	**.004**			
	Primary School	.127	58	**.021**			
Total Self-efficacy	Middle School				.948	49	**.030**
	High School	.091	62	**.200**	.958	62	.033

In Table 17, Kolmogorov-Smirnov test statistics are given at the father education level. Father's education level did not show normal distribution in anxiety scale. It showed normal distribution only for high school in self-efficacy scale. However, since skewness kurtosis values are between -1 and +1, it is assumed to provide normality for both scales (Tabachnick & Fidell, 2015).

Table 18: Kruskal Wallis test results of the anxiety and self-efficacy of secondary school students at the father education level

		Anxiety				Self-efficacy			
Father Education Level	**n**	**Mean Rank**	**X^2**	**df**	**p**	**Mean Rank**	**X^2**	**df**	**p**
Primary School	58	86.47				84.05			
Middle School	49	84.02	0.081	2	0.960	88.22	0.306	2	0.858
High School	62	84.40				83.34			

According to the father's education level in the math anxiety scale, according to Kruskal Wallis analysis results X^2 (2,169) = 0.081; It was calculated as p = 0.960. Accordingly, the anxiety scale did not differ significantly in the level of father education. According to Kruskal Wallis analysis results in self-efficacy perceptions scale X^2 (2,169) = 0.306; It was calculated as p = 0.885 and no significant mean difference was observed.

5. Discussion and Conclusion

In this study, it was investigated whether mathematical anxiety and self-efficacy perceptions of middle school students differ according to gender, grade level, and parental education levels. In addition, the relationship between students' math anxiety and self-efficacy was investigated. In the study, mathematics self-efficacy perceptions of female and male students were examined. There is no statistically significant mean difference between the self-efficacy perceptions of female and male students. Female students' self-efficacy averages are 95.48; self-efficacy averages of male students are 90.92, and girls 'self-efficacy is higher than boys' self-efficacy perceptions. There are studies that show that the self-efficacy of girls and boys towards mathematics does not vary depending on gender (Akay & Boz, 2011).

In this study, the mathematics anxiety of male and female students was examined. There is no statistically significant mean difference between the anxiety averages of female and male students. The average anxiety of female students is 50.66. The anxiety average of male students was 53.58, and the average of math anxiety of male was higher than that of female students. There are studies showing that there is a significant mean difference in math anxiety according to gender in the studies conducted, and that determines that boys' anxiety levels are higher (Peker and Şentürk, 2012). There are studies indicating that there is no significant mean difference between girls and boys (Bozkurt, 2012). It has been determined that there is a moderately significant relationship between math anxiety and mathematics self-efficacy perceptions of middle school students. It can be said that as students' math self-efficacy increases, their math anxiety decreases. This result of the study is also compatible with many previous studies (Doruk, Öztürk & Kaplan, 2016; Yılmaz, 2011).

Math anxiety and self-efficacy perception were examined in terms of grade level. As a result of the research, it is seen that the anxiety level of the 6^{th} and 7^{th} grade students is low and the anxiety levels of the 5^{th} and 8^{th} grade students are high. The reason for this may be that 5^{th} grade students encounter a new environment, meet different teachers, and adapt to the environment. The fact that the eighth grade will take the exam may have caused the doubts of the anxiety to increase in mathematics lesson with the changing examination system. Mathematics self-efficacy perceptions of secondary school students were examined at the grade level. As a result of the research, it was determined that the self-efficacy perceptions of the 6th grade students were highest, and the self-efficacy perceptions of the eighth grade students were the lowest. Significant differences were found between 6th and 8th grades, and 7th and 8th grade students in terms of self-efficacy perceptions. Adal and Yavuz (2017) found similar results in their study. He stated that self-efficacy perceptions of 5th, 6th and 7th grade students were higher than 8th grade students. It can be said that there is a decrease in self-efficacy perceptions with the coming exam.

Whether the level of parenting education affects students' math anxiety and self-efficacy was examined. It was determined that the anxiety averages of the students whose mothers are primary school graduates are the highest and the math anxiety averages of

the students whose mothers are high school graduates are the lowest. It was observed that the self-efficacy perceptions of the students whose mothers are primary school graduates are the least, and the self-efficacy averages of the students whose mothers are high school graduates are highest. Father's education level did not show a statistically significant difference with his math anxiety and self-efficacy perceptions. In our research, the fact that the education level of the parents did not vary may have statistically affected. When the studies are examined, it is seen that there are categories such as associate, undergraduate, graduate and doctorate degrees. In our study, it is seen that the education level of mothers is concentrated in primary school and the education level of father is in primary and high school. In his study with 314 eighth grade students, Delioğlu (2017) stated that mathematics self-efficacy perceptions of eighth grade students did not differ significantly from the level of mother education and father education. Bozkurt (2012), on the other hand, found a significant mean difference according to the education level of the mother and father. It was determined that the anxiety levels of the students whose mother and father graduated from university and above were lower than the students whose mother and father graduated from primary and secondary schools. This has been attributed to the fact that the family has failed to develop negative attitudes such as waiting from their children and create anxiety in the student. Parent education levels, attitudes and behaviors towards students have a significant effect on their self-efficacy and anxiety levels.

5.1 Suggestions

Students should be provided to develop positive attitudes towards mathematics in order to reduce their anxiety and their missing information should be completed. Teachers should make students feel a sense of accomplishment, and they should realize that mathematics is not a lesson to fear. Particularly, in order to reduce the anxiety of 5th grade, their adaptation to the new environment should be facilitated. Individual interviews with students can be made and factors that cause math anxiety can be determined. Solutions can be developed for this. Encouragement can be made to increase the student's self-confidence. Encouraging and motivating words can be said to solve questions. The lesson can be made more fun. The topics can be enriched with materials and the student's interest can be intensified.

Families should cooperate with teachers and provide the necessary support for the student. Sex discrimination from comparisons should be avoided. This study is a quantitative study. Further research can be carried out qualitatively and detailed research can be conducted on the causes of mathematics anxiety and factors affecting self-efficacy. The number of samples can be increased, and studies can be made with more variables. Exam grades can be examined by examining the success grades in the course and their relationship with anxiety. Experimental studies that monitor anxiety and self-efficacy changes can be done using new lecture methods.

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